

WHAT IS CLAIMED IS:

1 1. A method for generating a user interface, wherein an application program
2 processes data and generates application output and wherein a user interface module processes
3 the application output to generate output data to render on an output device, comprising:
4 generating output data, with the user interface module, to render on the output device in
5 response to processing statements in the user interface module;
6 reaching a processing point, with the user interface module, where the user interface
7 module does not include statements to generate output data;
8 receiving, with the user interface module, an interaction object from the application
9 program specifying data after reaching the processing point; and
10 generating output data to render on the output device from the interaction object.

1 2. The method of claim 1, wherein the interaction object further includes attribute
2 information indicating characteristics of the data to output, wherein the output data is rendered
3 in a format corresponding to the characteristics indicated in the attribute information.

1 3. The method of claim 1, wherein the user interface module comprises a
2 Controller and View and the application program comprises a Model conforming to the Model
3 View Controller architecture.

1 4. The method of claim 3, wherein the Controller includes the statements that are
2 processed to generate output data, further comprising:
3 requesting, with the Controller, the interaction object from the Model upon reaching the
4 processing point; and
5 transferring, with the Controller, the received interaction object to the View, wherein
6 the View generates the output data to render from the interaction object.

1 5. The method of claim 4, wherein the output data generated by the Model
2 includes questions, further comprising:
3 receiving, with the View, user input in response to the presented questions;
4 adding, with the View, the received user input to the interaction object including the
5 output data generated by the View; and
6 returning the interaction object including the received user input to the Model to
7 process.

1 6. The method of claim 5, wherein returning the interaction object including the
2 received user input to the Model further comprises:
3 transmitting, with the View, the interaction object including the answers to the
4 Controller; and
5 transferring, with the Controller, the Interaction Object including the received user input
6 to the Model.

1 7. The method of claim 1, wherein multiple user interface modules are capable of
2 generating output data from the interaction object, wherein each user interface module
3 generates the output data to render in a different format.

1 8. The method of claim 7, wherein each user interface module generates the
2 output data to render on a different type of output device.

1 9. The method of claim 1, further comprising:
2 continuing to generate, with the user interface module, output data in response to
3 processing statements in the user interface module after the output data generated from the
4 interaction object is rendered on the output device.

1 10. A method for generating a user interface, wherein an application program
2 processes data and generates application output and wherein a user interface module processes
3 the application output to generate output data to render on an output device by:
4 generating output data to render on the output device in response to processing
5 statements in the user interface module;
6 receiving an interaction object from the application program specifying data to generate
7 as output data;
8 generating output data to render on the output device from the interaction object from
9 the data specified in the interaction object;
10 receiving user input in response to the output data rendered on the output device from
11 the interaction object;
12 adding the received user input into the interaction object; and
13 returning the interaction object including the received user input to the application
14 program.

1 11. The method of claim 10, wherein the interaction object further specifies
2 attribute information, wherein the output data is rendered on the output device in a format that
3 corresponds to the specified attribute information.

1 12. The method of claim 10, wherein the interaction object comprises a plurality of
2 interactions, wherein each interaction includes data to cause the user interface module to render
3 a message or question on the output device.

1 13. The method of claim 12, wherein each interaction is capable of providing
2 information to cause the user interface module to generate a question that is a member of a set
3 of questions comprising:

- 4 a true false question;
- 5 an essay question; and
- 6 a multiple choice question.

1 14. The method of claim 12, wherein one or more interactions may include data to
2 render a multiple choice question by providing:
3 a question string comprising a question presented to the user;
4 a choice array comprising a plurality of user selectable choices to present as responses
5 to the presented question, wherein the choices in the choice array are presented on the output
6 device with a selection mechanism to enable selection of at least one of the choices; and
7 a selection array indicating which user selectable choices were selected through the
8 selection mechanism, wherein the selection array comprises the received user input in response
9 to the presented question.

1 15. The method of claim 14, wherein the interaction including data to render a
2 multiple choice question further includes:
3 an allowable selection variable indicating a maximum number of user selectable choices
4 that may be indicated as selected in the selection array.

1 16. The method of claim 10, wherein the user interface module comprises a
2 Controller and View components and the application program comprises a Model conforming
3 to the Model View Controller architecture.

1 17. The method of claim 10, wherein multiple user interface modules are capable of
2 generating output data from the interaction object, wherein each user interface module
3 generates the output data to render in a different format.

1 18. The method of claim 17, wherein each user interface module generates the
2 output data from the interaction object to render on a different type of output device.
3

1 19. A system for generating a user interface on an output device, comprising:
2 a computer readable medium;
3 an application program means for processing data and generating application output;
4 an interaction object included in the computer readable medium specifying data to
5 generate, wherein the application program means generates the interaction object; and
6 a user interface module means for generating output data to render on the output device
7 by performing:

8 (i) processing statements in the user interface module to generate output data to
9 render on the output device;
10 (ii) reaching a processing point where the user interface module does not
11 include statements to generate output data;
12 (iii) receiving an interaction object from the application program specifying data
13 after reaching the processing point; and
14 (iv) generating output data to render on the output device from the interaction
15 object.

1 20. The system of claim 19, wherein the interaction object further includes attribute
2 information indicating characteristics of the data to output, wherein the user interface module
3 means renders the output data in a format corresponding to the characteristics indicated in the
4 attribute information.

1 21. The system of claim 19, wherein the user interface module means includes a
2 Controller means and View means and the application program comprises a Model means
3 conforming to the Model View Controller architecture.

1 22. The system of claim 21, wherein the Controller means includes the statements
2 that are processed to generate output data, wherein the Controller means further performs:
3 requesting the interaction object from the Model upon reaching the processing point;
4 and
5 transferring the received interaction object to the View, wherein the View generates the
6 output data to render from the interaction object.

1 23. The system of claim 22, wherein the output data generated by the Model means
2 includes questions, wherein the View means further performs:
3 receiving user input in response to the presented questions;
4 adding the received user input to the interaction object including the output data
5 generated by the View; and
6 returning the interaction object including the received user input to the Model to
7 process.

1 24. The system of claim 23, wherein returning the interaction object including the
2 received user input to the Model is performed by:
3 transmitting, with the View means, the interaction object including the answers to the
4 Controller; and
5 transferring, with the Controller means, the Interaction Object including the received
6 user input to the Model.

1 25. The system of claim 19, further comprising: multiple user interface module
2 means capable of generating output data from the interaction object, wherein each user
3 interface module means generates the output data to render in a different format.

1 26. The system of claim 25, wherein each user interface module generates the
2 output data to render on a different type of output device.

1 27. The system of claim 19, wherein the user interface module means further
2 performs:
3 continuing to generate, with the user interface module, output data in response to
4 processing statements in the user interface module after the output data generated from the
5 interaction object is rendered on the output device.

1 28. A system for generating a user interface on an output device, comprising:
2 a computer readable medium;
3 an application program means for processing data and generating application output;
4 an interaction object included in the computer readable medium specifying data to
5 generate, wherein the application program means generates the interaction object; and
6 a user interface module means for generating output data to render on the output device
7 by performing:

8 (i) receiving the interaction object specifying data to generate as output data;
9 (i) generating output data to render on the output device from the interaction
10 object from the data specified in the interaction object;

11 (ii) receiving user input in response to the output data rendered on the output
12 device from the interaction object;

13 (iii) adding the received user input into the interaction object; and

14 (iv) returning the interaction object including the received user input to the
15 application program.

1 29. The system of claim 28, wherein the interaction object further specifies attribute
2 information, wherein the output data is rendered on the output device in a format that
3 corresponds to the specified attribute information.

1 30. The system of claim 28, wherein the interaction object comprises a plurality of
2 interactions, wherein each interaction includes data to cause the user interface module means to
3 render a message or question on the output device.

1 31. The system of claim 30, wherein each interaction is capable of providing
2 information to cause the user interface module means to generate a question that is a member of
3 a set of questions comprising:
4 a true false question;
5 an essay question; and
6 a multiple choice question.

1 32. The system of claim 30, wherein one or more interactions may include data to
2 cause the user interface module means to render a multiple choice question by providing:
3 a question string comprising a question presented to the user;
4 a choice array comprising a plurality of user selectable choices to present as responses
5 to the presented question, wherein the choices in the choice array are presented on the output
6 device with a selection mechanism to enable selection of at least one of the choices; and

7 a selection array indicating which user selectable choices were selected through the
8 selection mechanism, wherein the selection array comprises the received user input in response
9 to the presented question.

1 33. The system of claim 32, wherein the interaction including data to render a
2 multiple choice question further includes:
3 an allowable selection variable indicating a maximum number of user selectable choices
4 that may be indicated as selected in the selection array.

1 34. The system of claim 28, wherein the user interface module means comprises a
2 Controller and View components and the application program means comprises a Model
3 conforming to the Model View Controller architecture.

1 35. The system of claim 28, wherein multiple user interface module means are
2 capable of generating output data from the interaction object, wherein each user interface
3 module means generates the output data to render in a different format.

1 36. The system of claim 35, wherein each user interface module generates the
2 output data from the interaction object to render on a different type of output device.

1 37. An article of manufacture including code for generating a user interface, wherein
2 the code includes an application program that processes data and generates application output
3 and a user interface module that processes the application output to generate output data to
4 render on an output device by:
5 generating output data to render on the output device in response to processing
6 statements in the user interface module;

7 reaching a processing point where the user interface module does not include
8 statements to generate output data;
9 receiving an interaction object from the application program specifying data after
10 reaching the processing point; and
11 generating output data to render on the output device from the interaction object.

1 38. The article of manufacture of claim 37, wherein the interaction object further
2 includes attribute information indicating characteristics of the data to output, wherein the output
3 data is rendered in a format corresponding to the characteristics indicated in the attribute
4 information.

1 39. The article of manufacture of claim 37, wherein the user interface module
2 comprises a Controller and View and the application program comprises a Model conforming
3 to the Model View Controller architecture.

1 40. The article of manufacture of claim 39, wherein the Controller includes the
2 statements that are processed to generate output data, and wherein the Controller further
3 performs:
4 requesting the interaction object from the Model upon reaching the processing point;
5 and
6 transferring the received interaction object to the View, wherein the View generates the
7 output data to render from the interaction object.

1 41. The article of manufacture of claim 40, wherein the output data generated by
2 the model includes questions, further comprising:
3 receiving, with the View, user input in response to the presented questions;

4 adding, with the View, the received user input to the interaction object including the
5 output data generated by the View; and
6 returning the interaction object including the received user input to the Model to
7 process.

1 42. The article of manufacture of claim 41, wherein returning the interaction object
2 including the received user input to the Model further comprises:
3 transmitting, with the View, the interaction object including the answers to the
4 Controller; and
5 transferring, with the Controller, the Interaction Object including the received user input
6 to the Model.

1 43. The article of manufacture of claim 37, wherein multiple user interface modules
2 are capable of generating output data from the interaction object, wherein each user interface
3 module generates the output data to render in a different format.

1 44. The article of manufacture of claim 37, wherein each user interface module
2 generates the output data to render on a different type of output device.

1 45. The article of manufacture of claim 37, further comprising:
2 continuing to generate, with the user interface module, output data in response to
3 processing statements in the user interface module after the output data generated from the
4 interaction object is rendered on the output device.

1 46. An article of manufacture including code for generating a user interface, wherein
2 the code includes an application program that processes data and generates application output

3 and a user interface module that processes the application output to generate output data to
4 render on an output device by:
5 generating output data to render on the output device in response to processing
6 statements in the user interface module;
7 receiving an interaction object from the application program specifying data to generate
8 as output data;
9 generating output data to render on the output device from the interaction object from
10 the data specified in the interaction object;
11 receiving user input in response to the output data rendered on the output device from
12 the interaction object;
13 adding the received user input into the interaction object; and
14 returning the interaction object including the received user input to the application
15 program.

1 47. The article of manufacture of claim 46, wherein the interaction object further
2 specifies attribute information, wherein the output data is rendered on the output device in a
3 format that corresponds to the specified attribute information.

1 48. The article of manufacture of claim 46, wherein the interaction object comprises
2 a plurality of interactions, wherein each interaction includes data to cause the user interface
3 module to render a message or question on the output device.

1 49. The article of manufacture of claim 48, wherein each interaction is capable of
2 providing information to cause the user interface module to generate a question that is a
3 member of a set of questions comprising:
4 a true false question;

- 5 an essay question; and
6 a multiple choice question.

1 50. The article of manufacture of claim 48, wherein one or more interactions may
2 include data to cause the user interface module to render a multiple choice question by
3 providing:
4 a question string comprising a question presented to the user;
5 a choice array comprising a plurality of user selectable choices to present as responses
6 to the presented question, wherein the choices in the choice array are presented on the output
7 device with a selection mechanism to enable selection of at least one of the choices; and
8 a selection array indicating which user selectable choices were selected through the
9 selection mechanism, wherein the selection array comprises the received user input in response
10 to the presented question.

1 51. The article of manufacture of claim 46, wherein the interaction including data to
2 cause the user interface module to render a multiple choice question further includes:
3 an allowable selection variable indicating a maximum number of user selectable choices
4 that may be indicated as selected in the selection array.

1 52. The article of manufacture of claim 46, wherein the user interface module
2 comprises a Controller and View components and the application program comprises a Model
3 conforming to the Model View Controller architecture.

1 53. The article of manufacture of claim 46, wherein multiple user interface modules
2 are capable of generating output data from the interaction object, wherein each user interface
3 module generates the output data to render in a different format.

- 1 54. The article of manufacture of claim 53, wherein each user interface module
- 2 generates the output data from the interaction object to render on a different type of output
- 3 device.

54. The article of manufacture of claim 53, wherein each user interface module generates the output data from the interaction object to render on a different type of output device.